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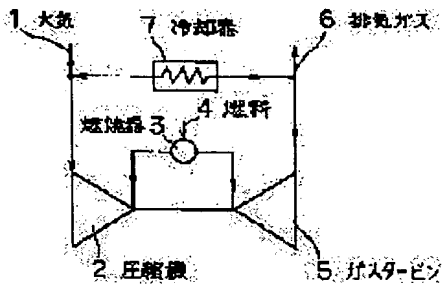
(54) LOW NOX COMBUSTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To burn and react fuel containing a nitrogen content in fuel in low oxygen air and suppress to the lower extent a rate that the nitrogen content is converted into NOx in a combustor using fuel containing the nitrogen content such as ammonia in fuel, by adding gas whose oxygen content is lower than the atmosphere in air for combustion.
SOLUTION: A gas turbine for coal gasification gas, drives a generator and the like in a manner that atmosphere 1 is compressed by a compressor 2 and led to flow into a combustor 3, coal gas is burnt as fuel 4 in the combustor 3, and the high temperature gas of coal gas is introduced to a gas turbine 5. In this case, a cooler 7 is arranged, by which exhaust gas 6 delivered from the gas turbine 5 is cooled. Exhaust gas 6 has a high concentration therefore, the temperature of the exhaust gas 6 is lowered by being passed through the cooler 7, and after that, it is supplied to the intake duct of the gas turbine 5 and mixed with the atmosphere 1 thereby, an oxygen content in air in the inlet part of a compressor 2, can be lowered. Thusly, exhaust gas 6 is added to air for combustion, therefore the conversion rate into NOx of a nitrogen content contained in fuel, can be suppressed to the lower extent.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Low NOx characterized by constituting in the combustor which uses the fuel containing nitrogen content, such as ammonia, so that gas with an oxygen density lower than atmospheric air may be added to a combustion air Combustor.
[Claim 2] Low NOx according to claim 1 which recycles its combustion exhaust gas as said gas Combustor.
[Claim 3] Low NOx according to claim 2 which is equipped with the condensator which cools said of its combustion exhaust gas, and supplied the combustion exhaust gas which carried out the temperature fall with this condensator to the compressor inlet-port section for combustion airs Combustor.
[Claim 4] The low-NOx-combustion machine according to claim 2 constituted so that a pressure might be made high by the compressor for exhaust gas pressure ups and said of its combustion exhaust gas might be supplied to combustor inlet-port air.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention -- coal gasification gas -- like -- the inside of a fuel -- ammonia (NH3) etc. -- it is related with the low-NOx-combustion machine applied to the gas turbine combustor which uses the gas containing nitrogen content (Fuel N) as a fuel.
[0002]
[Description of the Prior Art] The example of a network of the conventional gas turbine for coal gasification gas is shown in drawing 4 . The atmospheric-air air 1 flows into a combustor 3, after being compressed with an air compressor 2, it is burned within a combustor 3 by using as a fuel 4 the coal gas which occurred in the gasification plant (not shown), the elevated-temperature gas is led to a gas turbine 5, and it expands it, is taken out as an output, turns a generator etc., and is usually discharged out of a system as exhaust gas 6.
[0003]
[Problem(s) to be Solved by the Invention] It is NOx, in case the ammonia component contained in the coal of a raw material by coal gasification gas exists in fuel gas and this burns. It converts. This is the so-called Fuel. NOx discharged from a plant by the nitrogen content which is called NOx and exists in a fuel in this way Concentration becomes high. This is a problem which is not avoided in the combustor which uses the fuel containing a part for N, such as ammonia.
[0004] Therefore, overfuel combustion is performed in the first step, and it is N2 of NO. Reduction is promoted. What has taken the combustion technique, such as the so-called two-stage combustion method which burns an unburnt component completely in the second step, for example with an example of the test result in atmospheric pressure combustion conditions NOx in the coal gasification gas equivalent component gas which does not contain ammonia concentration -- several ppm it is -- a thing -- receiving -- the inside of a fuel -- NH3 About 900 ppm if it exists -- NOx concentration -- about 140 ppm in view of the result which increases sharply -- further low NOx Combustion is demanded.
[0005] This invention is NOx of the nitrogen content, even if it uses the fuel which contains nitrogen content in a fuel. Low NOx which can stop a conversion ratio low It is making to offer a combustor into the technical problem.
[0006]
[Means for Solving the Problem] Fuel according to combustion by falling the oxygen density in a combustion air by the basic test result NOx for N It became clear that a conversion ratio can be fallen. Fuel at the time of making it burn with air, although an example of the test result is shown in drawing 3 NOx for N To being about 40% (O mark in drawing), a conversion ratio is NOx to about 30% (** mark in drawing), if the oxygen density in a combustion air is made about 15%. A conversion ratio can be reduced.
[0007] This invention is low NOx constituted in the combustor which uses the fuel which contains nitrogen content, such as ammonia, in a fuel so that gas with an oxygen density lower than atmospheric air might be added to a combustion air based on this knowledge. A combustor is offered.
[0008] Low NOx by this invention Recycling of the own combustion exhaust gas with which the oxygen density is falling as low gas of an oxygen density used for a combustor can be carried out, it can constitute or the pressure up of the combustion exhaust gas in a jet pipe can be carried out by the compressor so that gas temperature may be reduced through a condensator and the combustion exhaust gas in exhaust gas may be supplied to the inlet-port section of a compressor as the supply gestalt, and it can constitute so that the combustor inlet-port section may be supplied.

[0009] Low NOx by this invention According to the combustor, the oxygen density in a combustion air falls into a combustion air by adding gas with an oxygen density lower than atmospheric air, such as own combustion exhaust gas. Inside NH3 of the fuel by combustion when the oxygen density in a combustion air is low It becomes smaller than the case where an NOx conversion ratio is air. Therefore, NOx which is discharged from a plant according to the combustor of this invention Concentration can be made low.
[0010]
[Embodiment of the Invention] Low NOx by the following and this invention A combustor is concretely explained based on the gestalt of operation shown in drawing 1 and drawing 2 . In addition, in the gestalt of the following operations, in order to simplify explanation, the same sign is given to the part of the same configuration as the conventional equipment shown in drawing 4 R> 4, and the explanation which overlaps about them is omitted.
[0011] (The 1st gestalt of operation) The combustor by the 1st gestalt of operation of this invention shown in drawing 1 is explained first. In drawing 1 , 7 is a condensator and cools the combustion exhaust gas 6 which comes out of a gas turbine 5. what showed the configuration of others of drawing 1 to drawing 4 , and parenchyma -- it is the same.
[0012] Since concentration is high, by letting a condensator 7 pass, the exhaust gas 6 of gas turbine 5 self lowers gas temperature, supplies it to the air intake duct of a gas turbine after that, it mixes with atmospheric air 1, and it reduces the oxygen density in the air in the inlet-port section of a compressor 2, carries out a pressure up with a compressor 2 after that, and supplies the combustion air of hypoxia concentration to the combustor 3.
[0013] Thus, NOx of the nitrogen content contained in a fuel when an oxygen density adds the exhaust gas of a gas turbine lower than atmospheric air to a combustion air An invert ratio can be stopped low.
[0014] (The 2nd gestalt of operation) Next, the combustor by the 2nd gestalt of operation of this invention shown in drawing 2 is explained. In drawing 2 , 8 is a compressor, pressurizes the exhaust gas 6 of a gas turbine 5, and supplies it to combustor inlet-port air. what showed the configuration of others of drawing 2 to drawing 4 , and parenchyma -- it is the same.
[0015] Since the combustor section has the high pressure, it cannot supply the exhaust gas of a gas turbine to a combustor 3 in jet-pipe internal pressure. Then, after making a compressor 8 draw and carry out the pressure up of the exhaust gas of a gas turbine, the combustion air of hypoxia concentration can be supplied to a combustor 3 by supplying the combustor 3 inlet-port section. In this way, an oxygen density adds gas turbine exhaust gas lower than atmospheric air in a combustion air, and the nitrogen in a fuel is NOx by combustion. The rate to convert can be stopped low.
[0016]
[Effect of the Invention] By adding gas with an oxygen density lower than atmospheric air, such as gas turbine exhaust gas with which the oxygen density fell to the combustion air in the combustor of this invention as explained above, for the combustion air which flows into a combustor, when it is in the condition that the oxygen density fell and the fuel which contains nitrogen content in a fuel performs a combustion reaction within this hypoxia air, that nitrogen content is NOx. The rate to convert can be stopped low.

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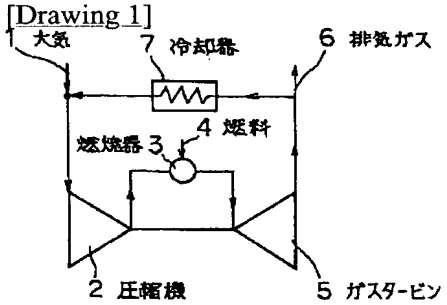
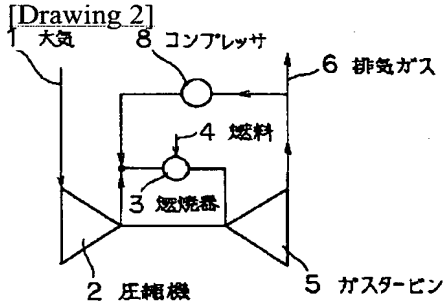
DRAWINGS

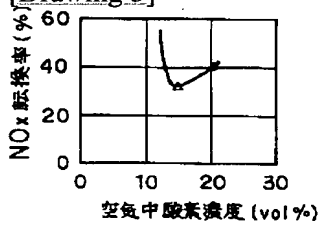
[Drawing 1]



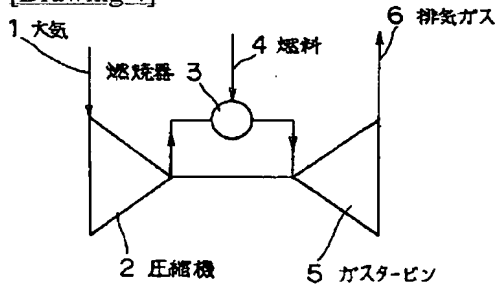
[Drawing 2]



[Drawing 3]



[Drawing 4]



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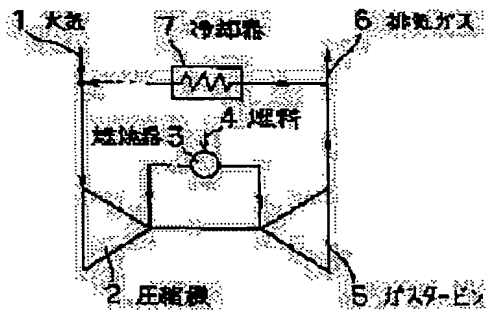

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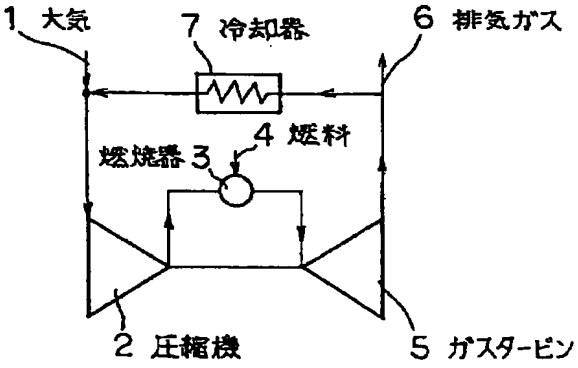
最終頁に続く

(54)【発明の名称】　低ＮＯｘ燃焼器

(57)【要約】
【課題】　燃料中に窒素分を含む燃料を使用しても、その窒素分のＮＯｘへの転換率を低く抑えることのできる低ＮＯｘ燃焼器を提供する。
【解決手段】　アンモニア等の窒素分を含む石炭ガス化ガスを燃料４とするガスタービン５の燃焼用空気中に、ガスタービン５自身の排気ガス６を冷却器７で冷却して添加している。これにより燃焼用空気の酸素濃度が低下し燃料中の窒素分がＮＯｘへ転化するのを抑える。



1

【特許請求の範囲】

【請求項１】　アンモニア等の窒素分を含む燃料を使用する燃焼器において、燃焼用空気に大気よりも酸素濃度の低いガスを添加するよう構成したことを特徴とする低NO_x燃焼器。

【請求項２】　前記ガスとして自らの燃焼排気ガスを再循環する、請求項１記載の低NO_x燃焼器。

【請求項３】　前記自らの燃焼排気ガスを冷却する冷却器を備え、同冷却器で温度低下させた燃焼排気ガスを燃焼用空気用のコンプレッサ入口部に供給するようにした、請求項２記載の低NO_x燃焼器。

【請求項４】　前記自らの燃焼排気ガスを排気ガス昇圧用コンプレッサで圧力を高くして燃焼器入口空気に供給するよう構成した、請求項２記載の低NO_x燃焼器。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、石炭ガス化ガスのように燃料中にアンモニア（NH_3）等の窒素分(Fuel N）を含んだガスを燃料とするガスタービン燃焼器等に適用される低NO_x燃焼器に関する。

【０００２】

【従来の技術】従来の石炭ガス化ガス用ガスタービンの系統例を図４に示す。大気空気１は空気圧縮機２にて圧縮されたあと、燃焼器３に流入し、ガス化プラント（図示せず）で発生した石炭ガスを燃料４として燃焼器３内で燃焼させ、その高温ガスをガスタービン５に導き膨張させて出力として取り出し、発電機等を回し、通常排気ガス６として系外に排出される。

【０００３】

【発明が解決しようとする課題】石炭ガス化ガスでは原料の石炭中に含まれるアンモニア成分等が燃料ガス中に存在し、これが燃焼する際にNO_xに転換する。これは、いわゆるFuel NO_xと称されるものであり、このように燃料中に存在する窒素分によってプラントから排出されるNO_x濃度が高くなる。これは、アンモニア等N分を含む燃料を使用する燃焼器ではさけられない問題である。

【０００４】そのため、一段目では燃料過剰燃焼を行なってNOのN_2への還元を促進し、二段目で未燃成分を完全燃焼するいわゆる二段燃焼法等の燃焼手法をとってはいるものの、例えば、大気圧燃焼条件での試験結果の一例では、アンモニアを含まない石炭ガス化ガス相当成分ガスでのNO_x濃度は数ppmであるのに対し、燃料中にNH_3が約９００ppm存在するとNO_x濃度は約１４０ppmと大幅に増加する結果からみても、更なる低NO_x燃焼が要求されている。

【０００５】本発明は、燃料中に窒素分を含む燃料を使用しても、その窒素分のNO_xへの転換率を低く抑えることのできる低NO_x燃焼器を提供することを課題としている。

2

【０００６】

【課題を解決するための手段】基礎試験結果により、燃焼空気中の酸素濃度を低下することにより燃焼によるFuel　N分のNO_x転換率を低下できることが明らかとなった。その試験結果の一例を図３に示すが、空気で燃焼させた場合のFuel　N分のNO_x転換率は約４０％（図中○印）であるのに対し、燃焼空気中の酸素濃度を約１５％にすると約３０％（図中△印）まで、NO_x転換率を低減することができる。

【０００７】本発明は、この知見に基づき、燃料中にアンモニア等の窒素分を含む燃料を使用する燃焼器において、燃焼用空気に大気よりも酸素濃度の低いガスを添加するよう構成した低NO_x燃焼器を提供する。

【０００８】本発明による低NO_x燃焼器に用いる酸素濃度の低いガスとして酸素濃度の低下している自身の燃焼排気ガスを再循環させることができ、その供給形態としては、排気ガス中の燃焼排気ガスを冷却器を介してガス温度を低下させ圧縮機の入口部に供給するように構成したり、あるいは、排気ダクト中の燃焼排気ガスをコンプレッサで昇圧し、燃焼器入口部に供給するように構成することができる。

【０００９】本発明による低NO_x燃焼器によれば、燃焼空気中に自身の燃焼排気ガスなど大気よりも酸素濃度の低いガスを添加することにより、燃焼空気中の酸素濃度が低下する。燃焼空気中の酸素濃度が低い場合、燃焼による燃料中NH_3のNO_x転換率が空気の場合より小さくなる。従って、本発明の燃焼器によればプラントから排出されるNO_x濃度を低くすることができる。

【００１０】

【発明の実施の形態】以下、本発明による低NO_x燃焼器について図１，図２に示した実施の形態に基づいて具体的に説明する。なお、以下の実施の形態において、図４に示した従来の装置と同じ構成の部分には説明を簡単にするため同じ符号を付してあり、それらについての重複する説明は省略する。

【００１１】（実施の第１形態）まず、図１に示した本発明の実施の第１形態による燃焼器について説明する。図１において、７は冷却器で、ガスタービン５から出る燃焼排気ガス６を冷却する。図１のその他の機器構成は図４に示したものと実質同じである。

【００１２】ガスタービン５自身の排気ガス６は濃度が高いため、冷却器７を通すことによりガス温度を下げ、その後ガスタービンの吸気ダクトに供給し、大気１と混合して圧縮機２の入口部での空気中の酸素濃度を低下させ、その後圧縮機２で昇圧して燃焼器３に低酸素濃度の燃焼用空気を供給している。

【００１３】このように、燃焼用空気に酸素濃度が大気よりも低いガスタービンの排気ガスを添加することにより燃料中に含まれる窒素分のNO_xへの転化率を低く抑えることができる。

【００１４】（実施の第２形態）次に、図２に示した本発明の実施の第２形態による燃焼器について説明する。図２において、８はコンプレッサで、ガスタービン５の排気ガス６を加圧して燃焼器入口空気に供給する。図２のその他の構成は、図４に示したものと実質同じである。

【００１５】燃焼器部は圧力が高いため、排気ダクト内圧ではガスタービンの排気ガスを燃焼器３に供給できない。そこで、ガスタービンの排気ガスをコンプレッサ８に導き、昇圧させた後、燃焼器３入口部に供給することにより、燃焼器３に低酸素濃度の燃焼用空気を供給することができる。こうして、燃焼用空気中に酸素濃度が大気よりも低いガスタービン排気ガスを添加して燃料中の窒素が燃焼によりＮＯｘへ転化する率を低く抑えることができる。

【００１６】

【発明の効果】以上説明したように、本発明の燃焼器では、燃焼用空気に酸素濃度の低下したガスタービン排気ガスなど大気よりも酸素濃度の低いガスを添加することにより、燃焼器に流入する燃焼空気は酸素濃度が低下した状態となっており、燃料中に窒素分を含む燃料がこの＊＊低酸素空気内で燃焼反応を行うことにより、その窒素分がＮＯｘに転換する割合を低く抑えることができる。

【図面の簡単な説明】

【図１】本発明の実施の第１形態による低ＮＯｘ燃焼器の構成を示すガスタービンの系統図。

【図２】本発明の実施の第２形態による低ＮＯｘ燃焼器の構成を示すガスタービンの系統図。

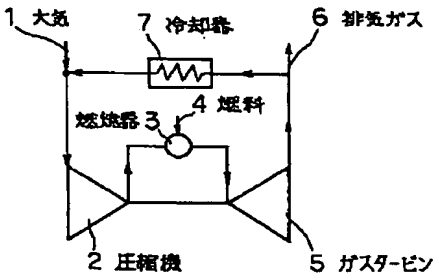
【図３】燃焼用空気中酸素濃度と燃料中窒素分のＮＯｘ転化率の関係を示す、本発明の基となる基礎試験結果の一例を示す線図。

【図４】従来のガスタービンの系統図。

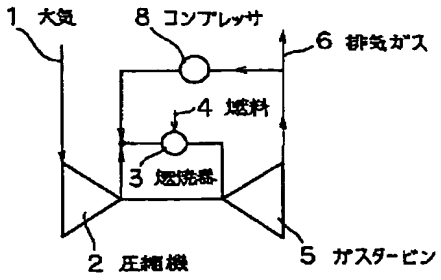
【符号の説明】

1　大気
2　圧縮機
3　燃焼器
4　燃料
5　ガスタービン
6　排気ガス
7　冷却器
8　コンプレッサ

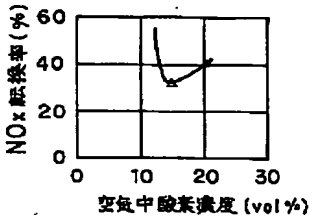
【図１】



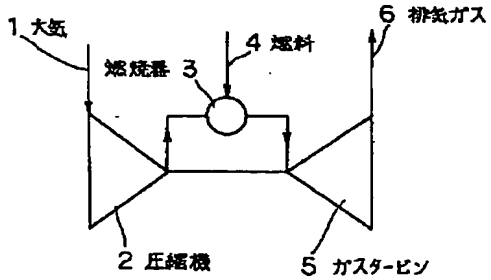
【図２】



【図３】



【図４】



フロントページの続き

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